

## Who teaches science to nurses?

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### Abstract

**Objective:** To explore the demographics of individuals teaching basic science courses in private nursing schools.

**Methods:** The study was conducted in Karachi, and comprised teachers teaching basic science courses in 16 registered private nursing schools. A demographic questionnaire was used to collect data. The study was conducted in the year 2013.

**Results:** Teachers holding academic/professional degrees in different science disciplines were involved in teaching science to nurses. In most of the schools, all the basic science courses were taught by one subject specialist science teacher. These subject specialist science teachers held degrees in different disciplines, which included Doctor of Philosophy, Master of Philosophy, Masters in Science, Bachelor of Medicine, Bachelor of Surgery, Bachelors in Engineering, Doctor of Pharmacy and registered nurse with a master's degree. Except the physicist(2), eleven (11) subject specialists taught two or more than two science courses. Microbiologist (4) and physiologist (5) were generally engaged in teaching all science subjects.

**Conclusion:** Science courses in nursing can be taught by anyone holding a bachelor or a master's degree in science or a professional degree.

**Keywords:** Professional nursing education, Teacher's beliefs, Subject specialist. (JPMA 67: 1013; 2017)

### Introduction

In almost every discipline of professional education, the role of foundational courses has its own importance. There are many professional schools that require the inclusion of basic science courses, called Common Foundational Programme Courses (FC), in their curriculum. These courses are usually a part of disciplines like medicine, pharmacy, engineering, etc. For instance, the first semester of the bachelors of pharmacy programme includes mainly science courses (e.g., mathematics and chemistry), which form a basis for more advanced pharmacy courses. The bachelor's in pharmacy curriculum is constructed as a continuum from basic science courses towards more advanced courses.<sup>1</sup>

The objective of including FC in the curriculum is to strengthen the foundation of professional students to enable them build a stronger knowledge structure for their professional practices. Pearson and Craig endorsed that the nursing students must be taught to draw upon bodies of knowledge traditionally believed to be beyond the realm of nursing and to work in inter-professional teams for best-quality patient care.<sup>2</sup> In this respect, the curriculum of Baccalaureate Nursing Degree (BScN) programme in Karachi has basic science and social science courses as foundational courses. The basic science courses include physics, chemistry, human anatomy and

physiology, bio-chemistry, nutrition and microbiology. A deep-level understanding in basic science courses is extremely important in promoting good-quality learning because these courses usually form an important base for future learning. Inadequate learning in basic courses may have long-term effects that get in the way of learning later in the students' studies.<sup>1</sup>

In the professional studies of nursing in Karachi, basic science courses are taught mostly by subject specialists' science teachers. Generally, the title "science teacher" is used for teachers teaching science in schools and colleges. In this paper, however, science teachers were referred to as those who taught basic science courses in professional nursing education. A subject specialist science teacher is someone who earned a masters' degree from a university in a particular science subject. For instance, it can be a microbiologist, chemist, physicist, physiologist, etc. Although Bachelor of Science (BSc) preparation does not produce subject specialist, BSc graduates have considerable subject knowledge of courses they choose to study. This leads to a general assumption that BSc graduates are qualified to teach FC to nurses. Therefore, BSc graduates are also engaged in teaching science to nurses, some nursing schools, mostly public, hire medical doctors to teach science subjects.

Hashweh elaborated that teachers create pedagogical models that reflect each teacher's values and his or her orientation to the discipline. These values and beliefs are reflected in his or her pedagogical practices.<sup>3</sup> On entering

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the context of professional nursing as science teachers, the science teachers have a different perspective regarding knowledge, teaching, learning, assessment and interaction with students. This is presumably because their beliefs are rooted in their disciplines and they are, therefore, more oriented towards imparting canonical scientific knowledge, which, for various reasons, is not always directly usable in everyday science-related situations. This situation creates a tension between the science teachers' pedagogical beliefs developed in academic institutions and the practices in the real workplace.

Science teaching and science teachers occupy a fair share in the terrain of research. However, what is under-researched is the knowledge and demographics of science teachers teaching in the professional schools of nursing in Karachi. Therefore, there is a need to know who are the science teachers teaching FC in private schools of nursing, Karachi.

The significance of the study can be seen at theoretical and practical level.

The practical significance of the study is that it was the first study that captures the science teachers' demographics in the professional nursing education in the context of Karachi. The study generated database of science teachers of private nursing schools of Karachi. This data base can be utilised for further studies or inquires in this particular area. It is hoped that the findings of this study will inform the educational practices of science teachers in professional education.

At theoretical level the knowledge generated will highlight the discrepancies found in the training of professionals and academics that impact the application of knowledge and its utility, respectively. It may, thus, facilitate the academic institutions to prepare graduates that are in line with the needs of the professional education. In relation to this, the findings will provide a basis for reviewing the existing curriculum of both professional and academic education institution.

Irrespective of the educational system/institution the students of BScN four-year degree programme are enrolled in, it is mandatory for them to complete 15 credits of basic science courses. Nursing as a field entails the selection and organisation of subject knowledge for the demands of practice from social and psychological sciences as well as from medicine, pharmacology, microbiology.<sup>4</sup> It is assumed that amongst other FCs, the knowledge specifically gained from science courses is utilised most in clinical practices. Few authors would

dispute that the practice of nursing is reliant upon a basic physiological knowledge.<sup>5</sup> Nurses rely heavily on an extensive knowledge base in anatomy and physiology, microbiology, chemistry and pathophysiology in their practice.<sup>6</sup>

The major objective of basic science courses is to teach scientific principles and concepts and their applications to nursing practice. Therefore, it is expected that at the end of the course of studies, a nurse utilises, relates and applies the learned knowledge and skills in their nursing practice. In fact, it is recognised that a greater potential for understanding and efficacy in nursing practice is achieved when scientific knowledge is incorporated into nursing care<sup>7</sup> and that research identifying the bioscience knowledge needed for safe nursing practice is needed.

In order to meet the expectations of the nursing students, basic science teaching learning has to be modified. This puts demands on science teachers teaching basic science courses to nurses to employ pedagogies that ensure an integration of basic science knowledge into meaningful networks of concepts and facts which nurses store, retrieve and apply to problems in clinical area. The science teachers' concept of teaching science, learning science, assessments and the science curriculum has to be oriented in ways that ensure maximum utility and application of scientific knowledge in clinical practice area. Hence, for science teachers to teach integrated science to student nurses, it is imperative for them to first understand the professional students' needs.

During the teaching sessions, mostly propositional knowledge "knowing that" related to scientific concepts is delivered to nurses. But keeping in mind their unique requirements as professional students, the propositional knowledge alone does not serve the purpose. In order to ensure maximum retention of the concepts taught, application of the learned concepts, scientific curiosity and scientific competence, procedural and conditional knowledge has to be part of classroom teaching. Procedural knowledge "knowing how", as the name implies, is knowledge in action; it must be demonstrated. A better example to differentiate between the two categories of knowledge is a theory-based discussion on application of positive and negative pressure and its relation with breathing categorised as propositional knowledge and demonstration of the same is categorised as procedural knowledge. Procedural knowledge may be job-dependent; hence, it tends to be less general than propositional knowledge. Conditional knowledge provides rationale for application of concepts that were learned as propositional knowledge. This knowledge is

about "knowing when and why" to apply declarative and procedural knowledge.

A research study involving high-school students placed in science-rich co-operative education settings found out that school learning is focused predominantly on propositional knowledge while workplace learning is focused predominantly on procedural knowledge.<sup>8</sup> They concluded that the science found in the workplace differed significantly from the science learned in schools. All three categories of knowledge are important for nurses; however, what matters more is who delivers it and how it is delivered.

Subject specialist science teachers engaged in teaching science to nurses are academically prepared either in universities and colleges. The knowledge in the universities/high schools (academic knowledge) is differently structured and acquired than the knowledge at work (knowledge-in-use). Bernstein theorises that the more vertical structure of academic knowledge, with its abstract language and guiding principles, suggests that it will not easily integrate with the more context-bound nature of work knowledge (horizontally structured discourse).<sup>9</sup> The approaches to the longstanding challenges of integrating subject-based and work-based knowledge have typically focused on the questions of how learning can be transferred from one setting to another, usually from theory to practice.<sup>4</sup>

Eraut<sup>10</sup> typifies workplace knowledge as being largely context-bound, acquired through interaction with similar contexts and adaptive to prevailing conditions which may include: the degree of collaboration/supervision; time constraints and their conditions of performance; the culture of the workplace; and unpredicted situations to which the worker must adjust. Most work knowledge is not codified and there is little time for critical reflection and analysis.

Hence, the knowledge given at the university and knowledge required at work has implication not only on the utilisation of knowledge at work. It influences those science teachers who acquire academic knowledge in high schools and universities and are involved in teaching science in professional education where scientific knowledge gained by professionals are meant to be utilised at work.

This paper is part of a large-scale doctoral study that aspires to explore the pedagogical beliefs of science teachers who teach basic science courses in professional nursing education in private schools of nursing in Karachi. With no baseline data of science teachers of private

nursing schools of Karachi available at hand, the demographic data was collected from the science teachers of basic science courses in private schools of nursing in Karachi. This paper explores the demographics of science teachers who taught foundational courses in private nursing schools.

### Subjects and Methods

The study was conducted in Karachi in the year 2013, and comprised teachers teaching basic science courses in registered private nursing schools. The process of data collection was initiated by negotiating access/entry through phone calls. A list of Pakistan Nursing Council (PNC)-recognised private schools of nursing was obtained through the official PNC website. Only those private nursing schools that were registered with the PNC five years ago were included. This ensured that they had graduated at least one batch of nurses.

During the process of data collection, especially during access and entry negotiations, it became clear that data from all the schools could not be collected as a number of them did not fulfil the selection criteria. The schools that were accessed for data collection either offered General Nursing Diploma (GND), or both GND and BScN, or BScN and post-registered nurse Baccalaureate in Nursing (Post RN BScN). Irrespective of the programmes offered by these schools and the number of science teachers there, the process of data collection was cumbersome for many reasons.

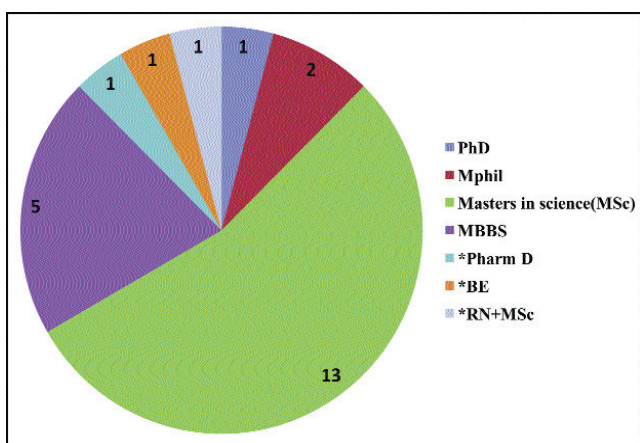
In the current study, it was assumed that access and entry to all private nursing schools would be easy. But this assumption was not correct. The process of data collection was initiated by negotiating access/entry through phone calls. Since any official or other sources who had updated landline/ cell phone numbers, addresses, and names of principal/director of the private schools of nursing could not be found, the author of the study used personal contacts and took help from official websites to develop a list of phone numbers and addresses of the required institutions. The list did not work satisfactorily as some of the numbers had changed and had not been updated. However, the participants and administrative staff who were accessed helped update the list of phone numbers. The author entered every institution with copies of permission letter and an information sheet of the study for the principal/director of the institution, and left both of them with the administrative staff. Some of the permission letters remained unattended and the phone call that followed them went unattended, too.

The demographic data was collected through a questionnaire. The demographic questionnaire was

organised from general to specific.<sup>11</sup> General information includes name, age and gender of the participants. The academic institutions (school, college and university) attended by the participants, subjects studied and any specialisation done were part of specific information. The questionnaire also gathered information regarding the present designation, status (part-time or full time) of the participant, affiliation with type of professional institutions (both academic and professional), years of teaching experiences in those institutions, subject/subjects taught (both science and non-science), and years of experiences in academic institutions. The demographic questionnaire enabled the collection of baseline information related to science teachers teaching in registered private nursing schools of Karachi. The information was collected once so it was cost-effective and less time-consuming. The information obtained through demographic questionnaire helped classify science teachers on the basis of their gender, age, academic background, years of teaching experience, job status (part-time/full-time), subject specialties and courses taught.

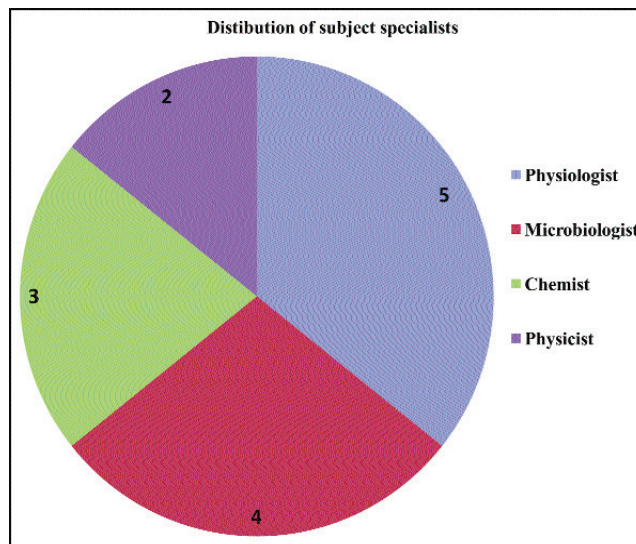
**Results**

Of the total 31 nursing schools, 26(83.87%) were based in Karachi. Of them, 16(61.54%) fulfilled the inclusion criteria. The data revealed that teachers holding academic/professional degrees in different science disciplines were involved in teaching science to nurses. These academic and professional degrees include: Doctor of Philosophy (PhD), Master of Philosophy (MPhil), Master



Pharm D: Doctor of Pharmacy  
 BE: Bachelors in Engineering  
 RN: Registered Nurse with masters in science  
 MBBS: Bachelor of Medicine, Bachelor of Surgery  
 PhD: Doctor of Philosophy  
 SON: Schools of nursing

**Figure-1:** Academic Qualification of Science teachers in Private SON, Karachi.



SON: Schools of Nursing.

**Figure-2:** Subject Specialist Science teachers in Private SON, Karachi.

of Science (MSc), Bachelor of Medicine, Bachelor of Surgery (MBBS), Bachelors in Engineering (BE), Doctor of Pharmacy (Pharm D) and Registered Nurse (RN) with a master's degree (Figure-1). Irrespective of which science degree science teachers hold, the private nursing schools hired them to teach basic science courses that were part of their curriculum

With the exception of medical doctors and the pharmacist, who taught only anatomy and physiology (considered as one subject in nursing curricula), all subject specialists which including physiologists, microbiologists, chemists and physicists taught two or more than two science courses. The demographic data explained that microbiologist and physiologist (subject specialist science teachers) were generally engaged in teaching all science subjects, whereas, physicists and chemists were teaching only physics and chemistry (Figure-2).

The teaching experiences of science teachers in nursing schools ranged from three months to twenty three years. A majority of the science teachers had teaching experiences of more than three years which shows minimum turnover of science teacher in nursing schools. This also indicates that they were well adjusted in their institutions and had developed better understanding of teaching learning needs of professional nursing education. In terms of numbers, the male teachers had a slight edge over their female counterparts. Most of the male science teachers were teaching part-time and were involved in teaching both in academic and professional

nursing institution.

## Discussion

In both private and public schools of nursing, the formal criteria for hiring science teachers for teaching basic science courses do not exist. This is coupled with the fact that there are no teacher training schools that train science teachers to teach in professional schools. Based on these facts the nursing schools hire science teachers irrespective of their domain of specialisation. Hence, the only criterion for employment is the possession of a degree in the discipline of science. This highlights that science courses in professional nursing education can be taught by anyone holding a bachelor or a master's degree in science or a professional degree, such as engineer, doctor and pharmacist.

The epistemological orientation and epistemological beliefs of science teachers holding degrees in different disciplines of science may not be the same. This consequently affects the ways in which basic scientific concepts are delivered to nurse students. The epistemological beliefs affect curricular and pedagogical decisions.<sup>12-14</sup>

The orientation of a professional degree holder, in terms of academic knowledge and its application, is different from that of a subject specialist. The professional education is a combination of training and preparation where there is a built-in internship period that enriches them with the practical knowledge, whereas, a subject specialist hardly gets the opportunity to apply learned concepts. This again influences the way science are taught in professional nursing education where the focus is more on the application that the core science concepts.

For professional degree holders, which include MBBS doctors, Pharm D, and engineers, it is relatively easy to find jobs in relevant professional fields. This is one reason why the percentage of subject specialist is more in number serving as science teachers in nursing school. This also reflects on the poor consumption of subject specialist in their relevant fields. The other way of looking at it is that these subject specialist are not trained enough to enter practical field after leaving university.

Male teachers have a slight edge over their female counterparts in that most of the male science teachers are teaching part-time and are involved in teaching both in academic and professional nursing institutions. The reason for this can be attributed to the fact that in a country like ours, commuting from one school to the other is a lot easier for males because they can make use of motorbikes, which is a fuel-efficient and convenient

mode of transport. Females, on the other hand, do not generally ride motorbikes in Pakistan. Some schools of nursing offer evening programmes and prefer male science teachers for social reasons. There are social norms; parents prefer girls to reach home before sunset; mothers have to reach home before their kids arrive from school and girls and mothers cannot spare evenings because of household responsibilities. Women, still the primary caregivers in families, may be more attracted to the profession than men in part because they can work the same schedules as their children.<sup>15</sup>

Gender and the preference for a particular domain of science was another interesting observation in the data. Among subject specialist most of the male science teachers were either a physicist or a chemist, whereas a majority of their female counterparts were microbiologist or physiologist. This selection reflects natural inclination of females towards natural science and males towards physical science. Career choices reflect the broad social structure and therefore tend to reinforce the current sex segregation of occupations. Examples include the greater propensity of women scientists to enter biological science rather than physical science fields and the lower propensity of men than women in general to respond to career setbacks by withdrawing from the workforce and devoting themselves to family responsibilities.<sup>16</sup>

Experience/interactions with science teachers in nursing schools suggest that their perception of research is generally restricted to bench work in a laboratory. Both the awareness and understanding of quantitative research amongst science teachers are relatively better than qualitative research. The author experienced the difficulty these people had in internalising the importance of her purely qualitative inquiry, based on subjective data, where she is researching the science teachers' beliefs through life history methodology. This attitude mirrors the beliefs on the objective nature of science held by those associated with the teaching and learning science. In an in-depth case study of a science teacher in Karachi, Halai found that the teacher had very positivist conceptions of science. Science was considered to be objective knowledge that could be obtained by following the scientific method. The teacher saw science as superior, value-free and a stable form of knowledge.<sup>17</sup>

## Conclusion

Science courses in professional nursing education can be taught by anyone holding bachelor or a master's degree in science or a professional degree. This also indicates the importance given to the basic science courses in nursing curriculum. The practical implication of this practice

eventually affects the clinical practices of nurses where they apply the learned concepts of science.

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**Conflict of Interest:** None.

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